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# PATENT SPECIFICATION



Application Date: Jan. 7, 1939.

No. 575/39.

511,475

Complete Specification Accepted: Aug. 18, 1939.

## COMPLETE SPECIFICATION

### Improvements relating to Universal Joints

Communicated by SPICER MANUFACTURING CORPORATION, of Toledo, Ohio, United States of America, a Corporation organised and existing under the laws of the State of Ohio, United States of America.

We, HARDY, SPICER & Co., LIMITED, a British Company, of Birch Road, Witton, Birmingham, 6, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The present invention relates to a universal joint of the kind in which a coupling member has trunnion-like engagements with driving and driven yoke-like members, at least one of the driving or driven members being built up of two parts detachably secured to one another, and particularly to such as is to be installed between the driving and driven shaft sections in motor-vehicle transmissions.

Our main object is to ensure that the characteristics of the joint will not be altered during the assembly operation.

A further object is to provide a universal joint so designed that it may be produced in smaller size and of reduced weight than was heretofore possible in universal joints capable of transmitting the same torque, whereby the cost of production will be reduced and the liability of the accidental development of unbalance in the universal joint minimized.

According to the invention, the parts of the built-up driving and/or driven member have an interlocking driving engagement with one another which is independent of the means by which they are secured together. When the coupling member is a spider, one of the said two parts is formed with eye-like openings to receive two of the spider arms, this part being adapted to have a driving fit with the other part. This other part may have lugs overlapping the eye-like openings in the first part and serving for retaining therein bearing caps for trunnions at the ends of the spider arms. These lugs may fit snugly into recesses in the first part and serve for the interlocking driving engagement. The two parts preferably have engaging surfaces perpendicular to their rotational axis.

In the accompanying drawings:—

Figure 1 is an elevation view, partly in section, of a preferred form of universal joint according to the present invention;

Figure 2 is a top plan view of the joint illustrated in Figure 1, portions of the joint being shown in section;

Figure 3 is an end view, Figure 4 a side elevational view, partly in section, and Figure 5 a top plan view, partly in section, of one of the parts of the driving member of Figures 1 and 2.

Figure 6 is an end elevational view, and Figure 7 a side view, partly in section, of the other of the parts designed to be interlocked with that of Figures 3, 4 and 5;

Figure 8 is a side elevation of the two detachable parts, partly in section, showing a modified construction; and

Figure 9 is a top plan view of the modification of Figure 8, partly in cross-section.

In the preferred embodiment of the invention illustrated by Figures 1 to 7, 10 designates one of the parts having internal splines 11 designed to receive the splined end of a shaft the torque of which is to be transmitted to the universal joint presently to be described. Secured to the part 10, in a manner hereinafter described in detail, is the other part 12 having a pair of arms 13 and 14 each provided with an eye-like opening 15 for the reception of oppositely disposed trunnions, and the bearings and bearing cups mounted thereon, of a coupling spider member 16, through which the torque is transmitted to a yoke-like member 17, having arms 18 and 19 each of which is likewise provided with an eye-like opening 20 for the reception of the other trunnions of the spider 16, and the bearing cups and bearings as hereinafter described. The member 17 is preferably formed integrally with a shaft portion 21 having internal splines 22 to receive the splined end of the shaft to which the torque is to be transmitted.

Preferably the spider 16 is formed so as to provide an annular shoulder 23 at the

base of each trunnion 24. A bearing cup 25 is fitted on the end of each trunnion 24, a sleeve of rollers 26 being disposed between the side wall of each cup and each trunnion 24. The outer surface of the cup bears against the end of the trunnion. Preferably the outer wall of the channel-shaped sheet metal ring 27 overlaps the side wall of the cup as illustrated, clearance being provided between the overlapping outer wall of the channel-shaped ring 27 and the edges of the cup. An annular recess may be formed in the edge of the cup to receive the outer wall of the sheet metal ring 22 as illustrated. The bearing cups 25 fit within the eye-like openings in the arms 18 and 19 and are held therein by snap-rings 29 sprung into grooves 30 cut in proper position in the walls of the openings in the arms.

The present invention is particularly concerned with the parts 10 and 12 and the way in which they are united. The part 10 has an enlarged cylindrical body portion 30<sup>1</sup> carrying flange-like elements 31 and 32 extending radially in diametrically opposite directions from the body 30<sup>1</sup>. Lugs 33 and 34 project forwardly from the flange-like elements 31 and 32, respectively. Surfaces 35 and 36 of the element 31 are machined to be accurately at right-angles to the axis of the shaft to which the part 10 is intended to be applied. Surfaces 37 and 38 of the element 32 are finished in the same manner. The member may be hollowed between the surfaces 35, 36, 37 and 38 as illustrated in the drawings so that the part 12 will bear against these surfaces only. The sides of the lugs 33 and 34 are finished so that the lugs fit as close as is practicable in recesses 39 and 40 cut into the body 41 of the part 12. The surfaces 42 and 43 of the lugs 33 and 34 respectively are accurately finished so as to bear as closely as practicable against the bottom walls of the recesses 39 and 40 of the part 12. The surfaces 42 and 43, at the ends of the lugs 33 and 34, are finished so as to be disposed the same distance from the axis of the shaft intended to be received by the part 10 and to exert the proper pressure on the bearing cups as hereinafter pointed out. Openings 44 and 45 for cap screws or the like are formed in the flange-like elements 31 and 32 inwardly of the

lugs 33 and 34 as illustrated.

The body 41 of the part 12 has its back 46 finished parallel to the axis of the aligned eye-like openings 15 in the arms 13 and 14, particularly where the back 46 contacts with the surfaces 35, 36, 37 and 38 of the part 10. Tapped openings 47 and 48 are formed in the body 41.

The construction just described permits ready assembly of the universal joint and ensures correct assembly thereof by relatively unskilled persons in the assembly line of a motor-car or like factory, enabling all assembly operations which might alter the characteristics of the joint to be made at the factory which manufactures the universal joint. The spider and the bearing cups, the bearings, the packings and the sheet metal shells that receive the packings are all assembled and secured in the arms 18 and 19 of the member 17 and in the arms 13 and 14 of the part 12. The snap-rings 29 retain the bearing cups permanently in the arms 18 and 19 in proper position. The bearing cups in the openings in the arms 13 and 14 of the part 12 are retained in the openings in said arms during shipment of this portion of the universal joint by pressing said cups into the arms under slight pressure. If desired, however, the cups and the bearings therein may be retained in the arms 13 and 14 by removable clips or straps during shipment of this portion of the joint. The part 10 is shipped to the point of assembly of the joint as a separate unit.

The joint may be assembled by inexperienced operators with a certainty that it will be properly assembled by sliding the shaft portion 21 on one of the shaft sections, thus connecting the spider 16, the part 12 and all of the parts carried thereby to the shaft through which the torque is to be transmitted. The part 10 is then slid upon the other shaft section and the lugs 33 and 34 of the part 10 are then reversely slid into the recesses 39 and 40 of the part 12. As already pointed out the lugs fit snugly in the recesses and accordingly pilot and properly locate the part 10 with respect to the part 12. In the assembled position the lugs 33 and 34 overhang the eye-like openings in the arms 13 and 14 and thus overlap the bearing cups 25 disposed in the openings. The lugs accordingly serve positively to retain the cups from outward movement on the trunnions in which they are fitted. After the parts have been assembled, as just described the cap screws 49, 50 are brought into threaded engagement with the threaded openings 47 and 48 in the body 46 of the part 12 through the openings 44 and 45 of the flange-like elements 31 and 32.

It will be appreciated that proper assembly of the universal joint is assured inasmuch as the lugs 33 and 34, and the walls of the recesses with which they engage, definitely determine the location of the separate parts 10 and 12. The ends of the lugs furthermore serve as definitely-located stops for the bearing cups which are assembled under a certain degree of pressure at the factory. Only sufficient clearance is provided between the lugs and the recesses of the part 12 to permit the parts to be slid into interlocked relation. The bearing cups are related to the ends of the lugs in such a way that it is necessary to apply a slight pressure to bring the cups beneath the lugs. The torque transmitted through the part 10 to the part 12 is transmitted through the lugs 33 and 34, which, as already stated, provide an interlock between these two parts. The cap screws 49 and 50 are accordingly not relied upon to take the torque transmitted, these screws being utilized merely to maintain the interlock brought about by sliding the lugs 33 and 34 in the recesses 39 and 40. This being the only way the joint can be assembled, it will be understood that no unbalance can be introduced in the assembled joint during the operation of completing the assembly, which operation is usually carried out by unskilled operators.

It will be understood that, while the yoke member at the left of Figures 1 and 2 may be constructed as an integral part of the shaft portion 21, as illustrated in these figures, if desired, a separately-constructed yoke-like member like that used at the right of the joint illustrated in the said figures may be employed, thus avoiding the necessity of cutting the grooves 30 that receive the snap-rings 29, or the need for these rings. In other words, this invention also contemplates a universal joint in which the construction at the left of Figures 1 and 2 is the same as that illustrated at the right of the said figures.

In the modification of the invention illustrated in Figures 8 and 9 of the drawings, one of the parts 51 is interlocked to the other part 52 having arms 53 and 54 in a different way. In other respects, the modification of these figures is the same as that already described. The interlock between the part 51 and the part 52 is brought about by a pair of lugs 55 and 56 which merely overlap the ends of the arms 53 and 54, and overhang the aligned openings therein so as to constitute stops for the bearing cups and the bearings therein after the spider has been assembled with respect to the part 52.

The body of the latter is positioned laterally with respect to the part 51 by being disposed snugly between flanges 57 and 58 bearing against opposite side walls of the part 52 adjacent the arms 53 and 54. It will be understood that the surfaces of these flanges and the sides of the part 52 are machined properly to locate the said part with respect to the axis of the shaft of the joint when the parts are in assembled relation. Cap screws 59 and 60 secure the part 51 and the part 52 together. The modification just described is used in the same manner as that already described with reference to the preferred form of the invention.

It will be observed that the universal joints just described are compact and easily assembled and that no portions of the parts 12 or 52, or the means for securing these parts to the spider, project in a direction to limit the possible range of angular movement between the parts of the joint. A joint constructed according to the present invention has less weight for a given torque capacity and is produced at lower cost than possible with joints heretofore made.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A universal joint including a coupling member having trunnion-like engagements with driving and driven members of which one at least is built up of two parts detachably secured to one another and having an interlocking driving engagement with one another which is independent of means securing the parts together.

2. A universal joint, according to claim 1, and in which the coupling member is a spider, one of the two parts (of which the driving or driven member is built up) being formed with eye-like openings to receive two of the spider arms, this part being adapted to have a driving fit with the other part.

3. A universal joint, according to claim 2, in which the said other part has lugs which, overlapping the eye-like openings, serve for retaining therein bearing caps for trunnions at the ends of the spider arms.

4. A universal joint, according to claim 2 or 3, in which the said parts have engaging surfaces perpendicular to their rotational axis.

5. A universal joint, according to claim 3, in which the lugs, fitting snugly into recesses in the said one part, serve for the interlocking driving engagement.

6. A universal joint having a driving or

driven member, to be connected to a coupling member, arranged substantially as hereinbefore described with reference to Figures 1 to 7 or Figures 8 and 9 of the 5 accompanying drawings.

Dated this 6th day of January, 1939.  
WALFORD & HARDMAN BROWN,  
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# PATENT SPECIFICATION



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## ERRATUM

SPECIFICATION No. 511,475.

Page 2, line 24, for "22" read "27"

THE PATENT OFFICE,  
April 15th, 1940.

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[This Drawing is a reproduction of the Original on a reduced scale.]

